

# Rutgers Physics 619 (Fields II) HW1

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Due date: Wednesday February 7, 2018

- 1) The Lorentz algebra is  $[M^{\mu\nu}, M^{\rho\sigma}] = i(\eta^{\mu\rho}M^{\nu\sigma} - (\mu \leftrightarrow \nu)) - (\rho \leftrightarrow \sigma)$ .
- i) Show that it satisfies the Jacobi identity  $[A, [B, C]] + [B, [C, A]] + [C, [A, B]] = 0$ .
- ii) Show that the rotations  $J_i = \frac{1}{2}\epsilon_{ijk}M^{jk}$  and boosts  $K_i = M^{i0}$  satisfy

$$\begin{aligned} [J_i, J_j] &= i\epsilon_{ijk}J_k \\ [J_i, K_j] &= i\epsilon_{ijk}K_k \\ [K_i, K_j] &= -i\epsilon_{ijk}J_k \end{aligned} \tag{1}$$

- iii) Show that  $N_i^\pm = \frac{1}{2}(J_i \pm iK_i)$  satisfy decoupled  $SU(2)$  commutation relations.
- 2) Read through chapter 38 and derive every spinor identity yourself. (You don't need to write any of this up, just make sure you do it as we will need these identities in class.)
- 3) Peskin 3.5
- 4) Peskin 3.6